U. S. DEPARTMENT OF AGRICULTURE.

REPORT

OF

THE BOTANIST

FOR

THE YEAR 1889.

AUTHOR'S EDITION.

FROM THE ANNUAL REPORT OF THE DEPARTMENT OF AGRICULTURE FOR THE YEAR 1889.

PUBLISHED BY AUTHORITY OF THE SECRETARY OF AGRICULTURE.

U. S. DEPARTMENT OF AGRICULTURE.

REPORT

OF

THE BOTANIST

FOR

THE YEAR 1889.

AUTHOR'S EDITION.

FROM THE ANNUAL REPORT OF THE DEPARTMENT OF AGRICULTURE FOR THE YEAR 1889.

PUBLISHED BY AUTHORITY OF THE SECRETARY OF AGRICULTURE.

REPORT OF THE BOTANIST.

U. S. Department of Agriculture,
Botanical Division,
Washington, D. C., January 4, 1890.

Sir: I have the pleasure to transmit herewith, for the Annual Report, a number of papers concerning the work of the Botanical Division.

Respectfully,

Geo. Vasey,
Botanist.

Hon. J. M. Rusk,
Secretary of Agriculture.

GENERAL STATEMENT.

RELATION OF BOTANY TO AGRICULTURE.

Agriculture is one of the oldest of the human occupations. For thousands of years the poor tillers of the soil have plodded along in a routine way, and in the meantime the very origin of most of the plants which they have cultivated has been forgotten. Very few of these plants now exist in the wild state, the greater part having been rescued from extinction by their continued employment in agriculture. The routine of the farmers' occupation is not productive of intellectual vigor, especially farm life that counts only the utmost employment of the muscular powers. The farmer should not be inferior in intelligence and education to other classes of human society. He needs to bring education to bear upon all the operations of husbandry. Almost every interest of farm life involves science in some form: geology in respect to the nature of the soil, chemistry in relation to plant food, entomology in the knowledge of beneficial or injurious insects, and botany in respect to the life, growth, cultivation, and improvement of the plants which engage his care and attention, as well as a knowledge of the diseases to which they are subject. Botany has special claims upon his attention. He should have an intimate acquaintance with the plants of agriculture, their history and relationships.

ADVANCE OF BOTANICAL SCIENCE.

Botany is one of the sciences which have made extraordinary progress during the past twenty years. Before that it had very little recognition even in our own best colleges. In academies and high schools it was taught in the most superficial manner, and the num-

ber of special students of botany were extremely few. A botanical laboratory for instruction in the vegetable tissues, their combinations and uses in plant structure, was then unknown. Now no college is well equipped without one. The science has shared in the general advancement of education. It has been greatly assisted by the formation of botanical societies and clubs, and by the publication of botanical periodicals. Another important agency in extending the science has been the organization of the agricultural colleges in this country. In these institutions it was early recognized that botany was one of the sciences which have practical relation to agriculture, and it became necessary to include it in the college course of study. There arose a demand for qualified teachers, and under this demand there has been developed a large number of instructors who have greatly improved the methods of teaching, have opened to the pupil new and interesting fields for investigation, and given new interest to the common objects of nature.

PURPOSE OF THE BOTANICAL DIVISION.

It is the purpose of the division to improve and elevate agriculture and to give it the benefit of scientific investigations in overcoming the enemies, especially vegetable, which the farmer encounters; to diffuse information respecting the many plants which are the subjects of agriculture; to teach how to make two blades of grass grow where one grew before; to investigate with reference to new and profitable kinds for culture, whether in the cotton fields, or in the wheat belt, in pastures and meadows, orchards, gardens, or vineyards. For purposes of this kind the division is open to the application of the humblest laborer, as well as to the thrifty farmer or the wealthy stock-grower. A new weed appears in the farmer's field or on his roadside; no one knows what it is or whence it came; the cattle become diseased or die from the effects of some unknown plant which they unsuspectingly eat on the mountain sides; application is made to the division; the plant is compared with its kindred in the herbarium and identified, and the question is solved. These are a few of the many ways in which the herbarium is of practical value. True, it contains thousands of plants which are entirely unknown to the public, and with which the public has perhaps no concern, but no one knows how soon the most obscure or insignificant plant may become a nuisance or a terror. Years ago a small parasitic plant was observed in the alfalfa fields of California. A few plants here and there did no harm, but soon they multiplied and spread; they wound themselves around the alfalfa stems and sucked its juices; they sent out their delicate threads in a network, and tied stalk to stalk for yards together, and sometimes they overran a whole field and bound the stalks together so firmly that the entire field might be shaken by pulling the stalks at one point. Botanical investigation showed that the destructive parasite was a species of dodder which had been introduced with the alfalfa seed from Chili. The farmers' crops are injured or destroyed by insects, or by the appearance of some fungous disease; his potatoes rot, his wheat rusts, his grapes mildew, his apples and pears blight, his oranges and other fruits are affected, and he spends his strength for naught. Then the scientist is called upon to investigate the nature and causes of the devastations and to devise some means to give relief.

USES OF THE HERBARIUM.

The fact that a botanist must understand a great deal about all kinds of plants is generally admitted, but as the use or necessity of a large herbarium in connection with practical botanical work is not so well understood, it may be worth while to say a few words on that subject. Were it possible to bring within the compass of these Department grounds, in a living condition, examples of all the different kinds of trees, shrubs, herbs, and other plants, high and low, which grow within the bounds of these United States; and if they were all the year long displaying their foliage, flowers, and fruits there would be comparatively little use for the herbarium, for the botanist could then study his plants from living examples. But ocean side, river banks, lake borders, dense forests, open prairies, dry plains, mountain plateau, alpine heights, and the greatest variety of climate, soil, and natural products can not thus be harmonized.

In a well equipped herbarium, however, examples sufficiently large for identification, of all our twelve thousand species of flowering plants and twice as many of the lower classes, may be securely stowed on its shelves and in its drawers, and be classified in such manner as to be convenient for examination and study at a moment's notice. The herbarium thus becomes a reference library, as indispensable for a naturalist as is a large library of books for the lawyer, statesman, clergyman, or physician. We glory in our great Library of Congress and spend millions of dollars in providing a suitable receptacle for it, because there all the literature of our own country and much of the literature of other countries is concentrated and made accessible, and that library is the resort of scholars and scientists from all parts of these States and Territories. All enlightened nations have established in their principal cities botanic gardens, national museums, and institutions of science, considering them to be indicative of their advancement in science and art.

In the city of London our English friends have what they call their Royal Herbarium, of which they are justly proud, for it is the largest in the world. There are represented not only every known plant of the kingdom, but all the known plants of their vast colonies in India, Africa, Australia, and America. It has been the custom of the nation to foster science; with their exploring squadrons they sent out scientists who brought home specimens of the productions of the countries which they visited or colonized. Collectors were sent into all the colonies; their vegetable productions were investigated, and specimens were collected and sent to the Kew Herbarium. These were elaborated and classified by the illustrious botanists connected with that herbarium. The material thus accumulated at headquarters made it possible for the British Government to publish its valuable colonial floras, as the flora of India, the South African flora, the flora of New Zealand, the flora of Australia, the flora of the British West Indies, etc., and finally enabled the accomplished botanists, Bentham and Hooker, to publish their Genera Plantarum, which is accepted as a handbook of the world's flora by botanists in all countries. The Botanical Division of this Department should be for this country what the Kew Herbarium and Museum is for England. Its opportunity for usefulness is expanding every day. Our vast country is becoming better known and more fully developed, new discoveries of plants

and other natural products are constantly being made, and a knowledge of these needs to be spread before the people, for popular information, by the Department.

EXPERIMENT GRASS STATION AT GARDEN CITY, KANS.

In the summer of 1886, under the direction of the Commissioner of Agriculture, the Botanist of the Department made an investigation of the grasses of the arid districts of Kansas, Nebraska, and eastern Colorado, with the object of ascertaining what were the prevailing species there, and to determine if any of them could be introduced into cultivation with the prospect of increasing the supply of pasturage in those districts. A report * of the investigation was published by the Department, from which we make the following quotations:

This region is bounded on the west by the Rocky Mountains and extends eastward to the one hundredth meridian, a distance of more than 300 miles. The elevation at the base of the mounains is about 5,500 to 6,000 feet. North of Colorado the mountain chain breaks down into the elevated Laramie Plains. This region is drained in the northern part by the Platte River, the north fork in Nebraska and the south fork in Colorado; by the Republican River in southern Nebraska; by the Smoky Hill in Kansas, and by the Arkansas and its branches in southern Colorado and Kansas. It is an immense, treeless plain, sloping eastward at the rate of about 10 feet to the mile. It is cut up in many places by dry channels called arroyas, which carry off the surface water and convey it to the larger streams. * * * There are some tracts of very sandy land, sometimes thrown into ridges and sometimes into small, shifting hillocks. But by far the larger part of this tract is a rich mixture of loam and clay, increasing in richness as we proceed eastward. * * * Near Denver, and northward on the Platte River and its branches, are some of the best agricultural lands of Colorado. They are irrigated by ditches and canals drawn from the mountain streams. In the southern part of the State the Arkansas River has been drawn upon for purposes of irrigation. But the irrigable lands constitute but a small part of the great plains. They are mostly elevated above the streams, and for a supply of water (other than the natural rain-fall), must depend upon wells and artificial reservoirs. The rain-fall over this region averages from 15 to 20 inches per year, increased occasionally in the southern part to 24 inches. * * *

Sufficient time has not elapsed to determine what will be the ultimate success of general agriculture in this section, but there can be no doubt that the country is eminently adapted to pastoral uses, and the settlers who are now filling up the country would do well to direct their efforts to stock-raising and dairy interests. * * * It has been argued that in this region agriculture can not be successful from a want of sufficient rain-fall, but it is now claimed by those residing on the soil that this is erroneous. It is said that in the natural condition of the soil the full benefit of the rain-fall is not obtained; that the ground is so densely packed that it is impervious to moisture, so that a large share of the rain-fall rapidly runs off into the arroyas and streams, as it would off a roof, whereas if the ground were plowed and pulverized a large part of the rain-fall would be retained. * * * Nature shows her willingness to respond to the ameliorating influences of cultivation. No sooner is the ground plowed and corn, sorghum, or millet planted than a crop many times as heavy as that of the native soil is produced. * * * And it is reasonable to expect that nature will be as ready to help in the production of perennial grasses as she is in the annual ones. There is every reason to expect that even the native Grama-grass may be made to double its yield by cultivation. But there is a considerable number of grasses native to that district which are more thrifty and productive than the Grama and Buffalo grasses, and if they were selected and sown upon properly prepared land there can be no doubt that a great improvement in the grass product would be effected. Indeed, we should extend our inquiries to foreign grasses cultivated in similar situations. But this is a question which can only be settled by experiment. Such grasses and forage plants require to be subjected to careful and protracted trials in order to obtain proof of their relative values under

* Bulletin No. 1, Botanical Division, Department of Agriculture. Report of an Investigation of the Grasses of the Arid Districts of Kansas, Nebraska, and Colorada. 1886.

different conditions of soil, moisture, and location. These experiments are difficult and expensive, and can not be made by private individuals; hence it is desirable that the Government should provide an experiment station in a central and characteristic location, where all the commonly cultivated grasses and forage plants, and also the most promising native ones. could be thoroughly tried under favorable conditions. This would be greatly in the interest of that large body of settlers who are now taking possession of the country, and who, without the aid of such information as could thus be obtained and communicated, will be exposed to many losses and disappointments in prosecuting agriculture under the peculiar circumstances here existing. A properly conducted and well continued series of experiments in this direction would result in discoveries of great value to the future residents of this arid district.

The statements and suggestions above quoted were made during the progress of the "boom" which induced thousands of poor men to rush onto the plains of Kansas and Colorado to try their fortunes in farming. The "boom" burst in the following year. A dry season occurred and the hopes of the farmers were blasted. Most of them had risked everything in the venture, and many were compelled to sell or abandon their lands or claims and seek employment elsewhere. This was especially the case in southwestern Kansas and the adjoining parts of Colorado.

At the session of Congress in 1887 an unsuccessful attempt was made to establish an experimental station; but at the next session, in 1888, provision was made for a station under the direction of the Commissioner of Agriculture. In August of that year a location at Garden City, in southwestern Kansas, was selected, that point being considered typical in soil and climate of a large region of surrounding country. The station is on the north bank of the Arkansas River, about 3 miles from the town. The object of the station was to make experiments with grasses and forage plants in order to ascertain what kinds were best adapted to culture in the arid districts. A public-spirited farmer, Mr. J. M. Jones, gave a free lease to the Government of 240 acres of level prairie land, lying about 40 feet above the level of the river. Prof. J. A. Sewall, of Denver, Colorado, a man thoroughly impressed with the importance of the work, and from experience well qualified for the undertaking, was appointed superintendent, and a beginning was made in September of that year. Eighty acres of the land were at once inclosed by a substantial wire fence. About 10 acres of the land had been broken and cultivated in previous years. This was now plowed thoroughly to the depth of a foot, and several plats of a few rods each were covered with sods of some six or eight kinds of native grasses collected in the vicinity. In the spring of the next year, 1889, a large number of grasses and forage plants, both native and foreign, were sown on the deeply plowed land, and were mulched with straw, chiefly for the purpose of preventing the action of the powerful winds which prevail there with such force as to sometimes sweep the seeds from the soil. The mulching had a good effect in protecting the surface, but an exceptionally bad effect in another direction. The straw had not been thrashed clean, and the seeds left therein dropped on the soil, germinated, stooled out, and threatened to smother the seeds which had been sown. Not only this, but it was discovered that the land had been full of foul weeds, and their successors sprang up in great abundance, and would have completed the ruin of the crops but for the expensive work of weeding by hand, which, although carefully performed, could not fail to remove some of the plants of the seed sown, so that the remaining crops were thin and had not a very satisfactory start. The sods that had been transplanted were

remarkably vigorous and productive. The principal native grasses sown were the following: *Agropyrum glaucum*, commonly called Colorado blue stem; *Andropogon furcatus*, commonly known as blue-joint; *Andropogon scoparius*, known here as wire bunch grass; *Chrysopogon nutans*, sometimes called wild oats; *Panicum virgatum*, sometimes called switch grass, and *Sporobolus cryptandrus*. About fifteen kinds of Indian grasses were sown, but almost wholly failed to germinate. Seeds from Europe were sown of meadow foxtail (*Alopecurus pratensis*), perennial rye grass (*Lolium perenne*), meadow fescue (*Festuca pratensis* and *F. elatior*), Hungarian brome grass (*Bromis inermis*), *Eleusine coracana*, *Trifolium incarnatum*, *Trifolium medium*, *Melilotus alba*, *Galega officinalis*, *Vicia villosa*, *Vicia hirsuta*, sainfoin (*Onobrychis sativa*), spurry (*Spergula arvensis*), and many others. Of these the perennial rye-grass, meadow fescue, spurry, Hungarian brome grass, and sainfoin were the most successful and promising at the end of the season.

In order to have feed for the teams employed, and to utilize and subdue the land, some 40 acres were broken and planted in several crops, as alfalfa alone, alfalfa with timothy grass and orchard grass, Johnson grass, and millet. These were irrigated from an adjoining ditch, made vigorous growth, and yielded large crops of hay, about 100 tons being put into stack. Another piece of land was planted with various kinds of sorghums, imphe, and Kaffir corn, and these without irrigation made a remarkable growth, some reaching a height of 10 feet. The Kaffir corn, although growing only about 6 feet high, produced the largest proportion of foliage (about 22 per per cent. of the entire plant), and was estimated to yield at the rate of more than 20 tons per acre. As might be expected, these experiments were attended with some failures and discouragements. But even the failures are instructive, for next to knowing what will succeed it is important to know what will not succeed. On the whole, the results of the experiments thus far are promising, although only a beginning has been made. The preparations for next year's experiments are extensive. The remaining 160 acres have been plowed aud fenced. About 40 acres have been sown to winter rye, which at the end of the season had made a very satisfactory growth. About 2,000 pounds of native grass seeds have been collected, with infinite labor and pains, and will be sown next spring. These will make fields of from 10 to 40 acres of some kinds. Several hundred pounds of foreign seeds have been imported, and it is believed that next season's experiments will give important results.

So important is the grass work considered that the Department has made arrangements with several of the experiment stations in the arid districts to co-operate with them in a series of experiments on grass and forage plants suitable for cultivation in such districts.

NOXIOUS WEEDS.

By F. V. Coville, Assistant Botanist.

The entire subjugation or extermination of the weeds here described can be secured only by perfect cultivation of the soil in which they grow. The required amount of cultivation is, however, too expensive, and certain indirect means of keeping out the weeds, or at least of preventing them from becoming too numerous, must be resorted to. In the case of annuals, since the plants die at the end

of the year, if, in addition, the seeds can be prevented from maturing, the remedy is easy. Although it is never possible in this way to kill every seed, so that there will be none to germinate, it is possible to greatly reduce the damage done by them. Of the weeds here described, charlock, stick-tight, mayweed, sow thistle, jimsonweed, and the thorny amaranth are annuals. In early summer they usually do not withstand the ordinary cultivation to which they are subjected. But in fence corners and out of the way places, and in fields after the crops are ripened, the weeds are commonly allowed to grow and mature their seeds unmolested. At this season mowing, burning, and plowing under, and that too before the seeds are ripe, are the best preventives that can be used. In the case of the perennials, hedge bindweed, yellow dock and bitter dock, the same method should be pursued, but it is ordinarily true of these plants that their seeds mature earlier in the season than do those of annuals, and their st onger roots enable them better to resist cultivation; and for this class of weeds the only remedy is constant cultivation.

ORDER CRUCIFERÆ.

CHARLOCK (*Brassica Sinapistrum*).

[Plate I.]

An erect annual, commonly 2 to 3 feet high, branching above. Stems smooth, or with a few short stiff hairs; leaves of very irregular form, commonly from ovate to obovate, irregularly sinuate-toothed, the uppermost sessile and not lobed, the lower petioled and lyrately pinnatifid; flowers in long bractless racemes terminating the branches, on spreading pedicels $\frac{1}{8}$ to $\frac{1}{4}$ inch long. Sepals 4, linear, $\frac{1}{4}$ inch long. Petals 4, the exserted, obovate, pale yellow limb $\frac{1}{4}$ inch long, on a claw of the same length. Stamens 6, 4, slightly exceeding the sepals, 2 a little shorter. Pistil slender, ovary with 2 parietal placentæ, 2-celled; style longer than the ovary, surmounted by a capitate stigma, the whble nearly equaling the longer stamens. Fruit, a capsule 1 to 2 inches long, slightly spreading, nearly cylindrical, tapering to an acute point, smooth, opening by 2 valves; valves splitting off from placenta to placenta, and from the base of the capsule to a point about two-thirds the distance to the apex, 3-nerved in addition to the marginal sutures; beak (part above the valves) empty or 1-seeded; seeds lying in a single row in the capsule.

A weed introduced from Europe, common in grain fields, especially in the northeastern United States, doing much damage by growing thickly over partly bare areas in early summer and choking out the grain that remains. The plants with which it is most liable to be confounded are yellow rocket (*Barbarea vulgaris**), black mustard (*Brassica nigra*), and white mustard (*Brassica alba*). The first may be identified readily by the comparatively many times shorter beak of the capsule; the second by its shorter, smaller capsule with one-nerved valves; the third, by its bristly—hairy capsule.

ORDER COMPOSITÆ.

PITCHFORKS (*Bidens frondosa*).

[Plate II.]

Plant annual, 2 to 6 feet high, erect, branching, nearly smooth, leaves opposite, petioled, pinnate; leaflets 3 to 5, lanceolate, acuminate, tapering into a short stalk below, coarsely serrate-dentate, sometimes reaching 5 inches in length. Heads terminating the branches, about $\frac{1}{2}$ inch high, broad, and many flowered. Involucre in 2 series; the outer scales foliaceous, linear or oblanceolate, ciliate, exceeding the head; the inner thin, oblong, acute, shorter than the flowers. Ray-flowers none or inconspicuous. Disk-flowers all fertile. Pappus of 2 downwardly barbed awns. Achenia flattened, wedge-oblanceolate, somewhat upwardly scabrous, the 2 awns persistent and rigid.

---

* Plate XIX, Ann. Rep. Bot. Dept. of Agr., 1886.

The plant is a native of the United States, but grows precisely like an introduced weed. It is found throughout the country east of the plains, and is especially disagreeable on account of the awned and barbed achenia, which stick fast to any object that they can penetrate, very commonly to clothing and to the wool of sheep. By this means the achenia and the seed within are disseminated.

We have several other species of *Bidens*, all of which have similar backwardly barbed awns on the achenia, but the remaining characters given above will distinguish this species from the others.

Bull Thistle (*Cnicus lanceolatus*).

[Plate III.]

Biennial; stem 2 to 4 feet high, usually much branched; leaves 6 inches long or less, lanceolate, bristly above, cobwebby beneath, pinnatifid, the lobes provided at the apex with very sharp stiff spines, sessile, the margins running down the stem into bristly ragged wings. Heads terminating the branches, about 1½ inches high just before expansion. Involucral bracts very numerous, imbricated, narrowly lanceolate, tapering into a slender spine-tipped apex; ray-flowers none; disk-flowers fertile, with pale red-purple corollas; pappus of copious plumose bristles.

This is the common thistle of Europe and has been naturalized throughout the country east of the plains. It is commonly found in pastures, but is by no means so persistent nor so troublesome a weed as the Canada thistle.* It is readily distinguished from that plant by its several times larger heads and the leaves bristly on the upper surface.

Sow Thistle (*Sonchus oleraceus*).

[Plate IV.]

Plant annual, 1½ to 4 feet high. Stem simple up to the inflorescence, succulent, smooth, glaucous. Leaves flaccid, smooth, glaucous beneath, alternate, oblong in outline, deeply pinnatifid, the lower lobes horizontal, the terminal deltoid, all with acuminate-aristate irregular teeth, the lower leaves on margined petioles, the upper sessile with clasping base, the auricles usually acute. Heads about ½ inch high, many-flowered, in a bracted cyme sometimes leafy below, the peduncles occasionally somewhat glandular-hairy. Involucral scales narrowly linear-lanceolate, thin, a few of the outer ones shorter; receptacle naked. Flowers all with yellow ligulate corollas; pappus of very fine and soft copious white hairs, a few in each flower coarser. Achenia flattened, oblanceolate, beakless, striate.

This plant, with another closely allied European species (*S. asper*), is naturalized throughout the country. In *S. asper* the leaves are usually not lobed, sometimes slightly so, the auricle evenly rounded, and the teeth more numerous, longer and stiffer; the achenia oblong-obovate, 3 to 5 nerved on each side, smooth. These two weeds somewhat resemble several other plants (the thistles and the wild lettuces) of the order Compositæ, but may be distinguished by the characters given in the description.

Mayweed (*Anthemis Cotula*).

[Plate V.]

Plant an annual; stem 1 to 2 feet high, sparingly cobwebby, either erect and simple below or with spreading branches at the base. Leaves numerous, alternate, commonly 1 to 2 inches long, twice or thrice pinnatifid, the ultimate segments short, linear, almost filiform, with a minute callous point, sparingly cobwebby.

* Plate VI, Ann. Rep. Bot. Dept. of Agr., 1886.

Heads terminating the branches, radiate; disk yellow, ¼ to ⅓ inch in diameter, globular, or finally ovoid. Involucral scales somewhat imbricated, lanceolate-oblong, appressed, with membranaceous margins, and apex acute or obtuse. Receptacle lanceolate in outline. Flowers of the disk fertile, the upper ones subtended by slender chaffy bracts. Ray-flowers neutral, the ligule white, ¼ to ⅓ inch long. Achenia oval-obovate, dirty yellow, about ¾ line long.

This weed has been introduced from Europe and is naturalized throughout the cultivated regions of the country, its particular place of growth being along roadsides, paths trodden by cattle, and pastures. It closely resembles a rather uncommon weed, also introduced, the field chamomile (*Anthemis arvensis*), but may be readily distinguished by the rank yarrow-like odor of its bruised herbage, by its neutral rays, and by the absence of chaff among the lower flowers. The chamomile is not rank-scented, has pistillate rays, and chaff throughout the head. In many parts of the West it is called dog fennel, or, to distinguish it from the yellow dog fennel (*Helenium tenuifolium*), white dog fennel.

ORDER CONVOLVULACEÆ.

Hedge Bindweed (*Convolvulus sepium*).

[Plate VI.]

Rootstocks slender, creeping, perennial; stems slender, few to several feet long, creeping or twining. Leaves alternate, scattered, long-petioled (commonly 1 to 2 inches), hastate, 1 to 3 inches long, tapering at the apex to an obtuse or acute point, the basal lobes acute or obtuse, sometimes with one or two large blunt teeth or lobes near the base, usually entire. Flowers single in the axils, on naked peduncles exceeding the leaves; the base of the flower closely invested by two opposite, sessile, ovate, foliaceous bracts ⅔ to 1 inch long. Sepals 5, similar in form to the bracts, but smaller and of more delicate texture. Corolla open funnel-form, 1½ to 2½ inches long, from white to rose-purple, the margin nearly entire. Stamens 5, inserted on the base of the corolla, included. Pistil 1; ovary 1 or 2 celled; style single, slender, included; stigmas 2, oblong, flat. Capsule included in the calyx and bracts, 4 seeded.

The plant is a native of our country, but is found as well in Europe, Asia, and elsewhere, widely scattered. It varies much in foliage, some forms being densely short-pubescent and with small narrow leaves. It is found in most districts east of the Rocky Mountains in moist situations along streams and fence-rows, and in cultivated fields and meadows. It creeps and twines over low bushes and walls, frequently causing much damage and much annoyance to farmers by twining about and choking field crops and grass. It closely resembles the morning glories (*Ipomœa*) and the common bindweed (*Convolvulus arvensis*), a plant not yet so widely naturalized in this country; but from both it may be distinguished by the presence of the pair of bracts at the base of the calyx.

ORDER SOLANCEÆ.

Jimson Weed (*Datura Stramonium*).

[Plate VII.]

Annual; stem 3 to 6 feet high, smooth, branched from near the base, the branches spreading. Leaves alternate, petioled, ovate-oblong, coarsely and irregularly toothed or lobed, with acute or acuminate teeth and apex, smooth when mature. Flowers single in the forks of the branches, short peduncled, erect. Calyx tubular, 1½ to 2 inches long, with 5 lanceolate acute teeth. Corolla 3 to 4 inches long, white, fun-

nel-shaped with a spreading 5 angular margin, the angles with short filiform points. Stamens 5, inserted near the base of the corolla; filaments long, but included. Pistil 1; ovary 4-celled, many-ovuled; style long, included, with 2 oblong stigmas. Fruit a stiff ovoid spiny capsule about 1½ inches long, provided at the base with a collar composed of the remains of the calyx. Seeds very numerous, kidney-shaped, pitted, ⅛ inch long.

The species is found throughout the country, but is especially abundant in the states east of the plains. It grows in cultivated fields, along roadsides, in fence corners, and various waste places. It is an introduced weed supposed to have come from Asia. Another species (*D. Tatula*), introduced from tropical America, has about the same distribution, but is in most districts less common. It differs by having the stem (which in *D. Stramonium* is green) purplish and the corolla pale purple. The common name is a corruption of Jamestown weed. It is also called thorn-apple and stramonium; and all three names, with "purple" prefixed, are applied to *D. Tatula*.

ORDER POLYGONACEÆ.

Yellow Dock (*Rumex crispus*).

[Plate VIII.]

Perennial; root single, thick, vertical, a foot or more long, tapering gradually below, almost without rootlets. Stem erect, 1 to 4 feet high or even taller, striate-angled, thick (sometimes ⅜ inch). Leaves narrowly oblong-lanceolate, tapering to base and apex, smooth or nearly so, the margins undulate, the radical and lower blades 3 to 9 inches in length and long-petioled, the upper shorter and becoming sessile. Flowers on slender recurved pedicels, jointed near the base, whorled along the branches of a contracted panicle 6 inches to 2 feet long, which is leafy-bracted below. Sepals 6, the 3 outer smaller, lanceolate, forced backward in fruit by the margins of the others; inner ovate, usually obtuse, enlarging in fruit and becoming somewhat heart-shaped, 1½ to 3 lines long, reticulate-veiny, entire or with minute teeth at the ends of the veins, one at least with a large grain-like body on the back. Stamens 6, not exceeding the sepals. Pistil 1, with 3 short styles and feathery stigmas; ovary 1-celled. Fruit an ovate, sharply triangular, smooth and shining, dark brown achenium or nut.

The plant is introduced from Europe and naturalized in most regions across the continent. It grows in lawns, meadows, pastures, and among field crops, its perennial root rendering it unusually difficult to extirpate. The wavy margins of the leaves have given rise to the specific name *crispus* and to the common name "curled dock" by which it is often known. The root is sometimes used medicinally, resembling rhubarb in chemical composition, and having tonic, astringent, and slightly laxative properties.

Bitter Dock (*Rumex obtusifolius*).

[Plate IX.]

Plant closely related to *R. crispus*, but with the following differences: Leaves all petioled, oblong-ovate, the base obtuse or heart-shaped, the apex obtuse, not conspicuously undulate. Panicle slender, the whorls of flowers somewhat distant. Inner sepals deltoid-lanceolate, with 2 to 5 slender, weak teeth on each side near the base.

This species is about as widely naturalized as *R. crispus* and is of very similar habits. It may be distinguished by its broader leaves, slenderer panicle, and the teeth of the inner sepals. The veins of the leaves are often reddish. A hybrid between the two species is of frequent occurrence. It is characterized by leaves nearly those of *R. crispus*, and with the teeth of the sepals very much shortened.

ORDER AMARANTACEÆ.

THORNY AMARANTH (*Amarantus spinosus*).

[Plate X.]

Plant annual, erect, much branched, 1 to 3 feet high, smooth. Leaves alternate, ovate to lanceolate, sharply pointed, 1 to 3 inches long, on petioles of the same length, smooth on both sides; each leaf bearing in its axil 2 abruptly diverging, sharp, stiff spines about $\frac{1}{3}$ inch long. Flowers greenish, small, in clusters in the axils of the leaves below, passing above at the ends of the branches into slender, flexuose, leafless spikes. Male flowers borne toward the apex of the spike; sepals 5, lanceolate, minutely aristate; petals none; stamens 5. Female flowers borne lower down, and similar; pistil 1, with 3 styles. Seed borne in a thin membranaceous bag or sac, lens-shaped, brown, shining, about $\frac{1}{2}$ line in diameter.

This plant has been introduced into the United States from tropical America, and has spread throughout the middle and southern regions east of the plains. It is rarely found north of New Jersey, Pennsylvania, and Illinois. Its spines distinguish it at once from all of our other amaranths. It is essentially a southern weed, growing in out of the way places and to some extent in cultivated fields, the spines rendering its presence particularly disagreeable.

SHORTIA GALACIFOLIA.

A RARE AND INTERESTING PLANT OF THE MOUNTAINS OF NORTH AND SOUTH CAROLINA.

[Plate XI.]

In the year 1839 Dr. Asa Gray, while examining the herbarium of Michaux at Paris, came upon an unnamed plant, new to him, found, according to the label, in the mountains of Carolina. It was collected there by Michaux in 1788 during his travels in America. He had been unable to identify it with any species or even genus which he knew, and as the specimen was so incomplete (a fruiting one without flowers) he placed it undescribed among his unknown plants.

During an excursion made in that region in 1841 Dr. Gray was unable to find the plant, and in the report of the species collected on the trip he inserted a description of the specimen found in Michaux's herbarium. By reason of the special interest attached to the plant on account of its close relationship with certain others, some found only in eastern Asia, the remainder in eastern America, search was made by many collectors for this species, but to no avail. In 1877, however, the plant was accidentally rediscovered, this time in flower, by Mr. G. M. Hyams, on the banks of the Catawba River, near Marion, McDowell County, N. C., in the lower mountains of the Alleghanies. Not a great abundance of specimens was found, but a sufficient number to clearly settle the relationship of the plant, of which complete descriptions were then published by Dr. Gray.

Unfortunately the call for so rare a plant nearly or quite stripped this at that time the only known locality. Again *Shortia* bade fair to become an extinct plant with a finished history, but again it has come to light. In 1886 Dr. C. S. Sargent visited the headwaters of the Keowee, the eastern branch of the Savannah, and here following up, by means of Michaux's diary, the trail of another plant, he found *Shortia* in the very region in which Michaux had discovered it, in the high mountains of Carolina.

Since that time a local botanist, F. E. Boynton, has found that the plant occurs in the same region in inexhaustible quantities. The

particular locality, as described in a letter from Mr. Boynton, is on the White Water and Toxiway Rivers in South Carolina, from a short distance south of the North Carolina boundary down to the junction of these two rivers as the Keowee. It is very abundant on the little brooks that flow into the White Water.

The plant belongs to the order Diapensiaceæ, of which there are only three other species in the United States. It is well worthy of cultivation because of its intrinsic beauty, and its history makes it still more attractive. It has a slender creeping rootstock from the end of which rise a few long-petioled, oblong or orbicular, toothed, evergreen leaves; and a few slender peduncles, each bearing a single primrose-like flower about an inch in diameter, with toothed petals. It succeeds well in a half shady place, with a cool house in winter, in a mixture of two parts peat and one part loam. In its native region it flowers very early in spring, even before the trailing arbutus. Mr. Boynton collected it in full bloom in the latter part of March.

THE EXTERMINATION OF NUT GRASS.

The following is an abstract from an article published by the Hon. G. D. Tillman in a southern agricultural paper.

A figure and description of the nut grass (*Cyperus rotundus*), or coco, were published in the Annual Report of this Department for 1887 (p. 309, Pl. XIII).

The plan of campaign to extirpate nut grass is simply to prevent it maturing seed above ground. Nearly everybody thinks that the nuisance reproduces itself from the nut alone, whereas it propagates a thousand times more from the seed. Hence to effectually and quickly destroy nut grass on any land infested with it, the soil should be frequently stirred during the growing period of summer so as to stimulate each nut and seed to sprout and come up. It is a waste of effort to attack coco in winter, either by digging or plowing or turning hogs on it. The best time for fighting it is between midsummer and frost time, although myriads of the sprigs will show themselves above ground in a day or two after each working of the soil, even in the spring months, yet no seed-stem will shoot up till late in the season, and the secret of success, as before remarked, is merely to cut down every tall stem, while in the flowering stage at the latest, and the sooner the better.

The old method for destroying coco, by cutting it off under the surface of the ground every time a sprig appears above the surface is a useless expenditure of labor.

The ground should be often stirred with the plow or hoe, from April to frost, as before mentioned, to make every nut and seed come up if possible, and as soon as possible, but there is no urgent necessity, as far as eradicating the grass is concerned, to kill its sprigs until they begin to shoot up seed-stalks. For this purpose it is only requisite to plow up or chop down the grass at the regular intervals of working Indian corn, collards, or any other crop. Still it is advisable to plant the land in some tall-growing crop which shall neither cover nor obscure any coco seed-stem so as to prevent it being observed and destroyed.

By the above method two years are ample time in which to rid any ground of coco. In fact, one season is sufficient to eradicate it, except that a few scattering sprigs will show themselves in subsequent years, which can easily be prevented from going to seed by close attention. One cause that has enabled coco so long and so defiantly to hold its sway in the South is that we have so few crops which are hoed or plowed in the fall of the year. This, together with the popular error that coco propagates from the nut alone, explains the whole story of its universal triumph over the patience, sweat, curses, and blows of the millions who have warred on it.

It was further found by Mr. Tillman that the seeds of the nut-grass pass through the alimentary canal of horses with unimpaired vitality, and that manure from horses fed with nut-grass hay quickly seeded the ground on which it was used. This is an important fact, and means that nut-grass hay containing ripe seed should never be fed to stock.

FLORIDA PLANTS.

By J. H. Simpson, Manatee, Fla.

NOTES ON GRASSES.

Paspalum distichum, called joint grass, is common in Florida, and is generally found in low lands, though it is said to grow equally well on high ground. I have frequently found it growing along roads where other grasses had been exterminated. Mr. Reagan, of West Florida, says it grows on any kind of soil, and that drought does not affect it. It spreads very rapidly, rooting at every joint. It is a good grazing and lawn grass, and is easily transplanted. It is also a most valuable pasture grass.

Paspalum platycaule, called lawn grass or Louisiana grass, usually grows on low rich land, but is perfectly at home in poor pine land. As a pasture grass it can not be excelled, and is also an excellent lawn grass. No amount of grazing or trampling by stock will affect it. The more it is grazed and run over the more dense it becomes. The celebrated Miakka Valley, where thousands of head of stock are pastured all the time, is covered with this grass. Two years ago last June I examined it at the close of the dry season, and though it was cropped to its utmost extent, yet it was a perfect dense mat without a break or bare spot, although it had been grazed ever since the settlement of the country. It flourishes in my yard, which is a miserable quality of pine land. It will stand severe grazing during long droughts, and remain under water for weeks without injury.

Panicum Crus-galli, or barn yard grass. This grass produces immense crops of hay and can be cut twice a year, and then pastured until it dies. It should be cut while in blossom, as, if that be delayed until the seed ripens, the culms become woody. When once established it requires no seeding, but comes up every year of its own accord the same as crab-grass. Stock do better on it than on most other kinds of hay or fodder. I have it growing in poor pine land and the culms sometimes attain a height of 6 or 7 feet.

Panicum gibbum.—This most valuable grass seems to have been entirely overlooked as far as its qualities for hay and pasturage are concerned. It usually grows in wet places with culms 2 to 3 feet high, but I have seen specimens that measured more than 5 feet. The late J. H. Harris, of Braidentown, informed me that he believed he could mow from 3 to 5 tons per acre of the most excellent hay, and that it was also an excellent pasture grass. He had experimented with it for years, and was satisfied that it was a valuable grass for hay and pasture.

Panicum sanguinale, the common crab grass or finger grass. This is a nutritious and valuable grass for hay. The great trouble for hay in Florida is, that it is not ready to mow till after the rainy season sets it, when it is almost impossible to cure it. It makes excellent pasture until it dies down.

Panicum virgatum.—This would undoubtedly be a valuable grass for hay in Florida, as it so nearly resembles the cultivated Guinea grass which is so highly prized for hay. Could it be set close together in a damp meadow, so as to make a good stand, the yield of hay would certainly be immense.

Setaria macrostachya, or pigeon grass. This is a wild species of

millet, resembling Hungarian grass. It grows tall, frequently 6 feet high, with erect spikes. It grows in low lands and is also perfectly at home on the poorest pine land. It should be cut early to make good hay.

Andropogon provincialis, blue joint. This is one of the grasses known for hay. It is also good for pasture as long as it lasts, but in a few years stock will kill it by continual grazing and trampling. It is equal to the best tame hay known. Having mowed, handled, and fed many tons of it for seven or eight years I know whereof I affirm. All the andropogons in the State I am satisfied would be valuable for hay.

Cynodon Dactylon, Bermuda or scutch grass. I consider this the best lawn grass for this region. It is perfectly at home in the poorest pine land, forming a dense sward that is there to stay. Care should be taken to plant it in pasture or lawn only where it is intended that it should remain, as it is difficult to eradicate it. It is a most excellent pasture grass, and seems to be adapted to the dry sandy soil of Florida.

Panicum Curtisii, commonly called maiden cane. It has been stated that this species never bloomed, and that specimens with hairy sheaths were distinct from those with smooth sheaths. I have ascertained that where the land is wet and rich enough so that it has sufficient vitality to produce both root-stocks for the next year and culms for the present year, it does bloom; but when the land is so dry and poor that it can not produce both, it will produce the root-stocks alone, and in that case will not bloom. I have ascertained that the specimens with hairy sheaths are from the same plant as that with smooth sheaths. It is likely to prove a valuable forage grass.

OTHER PLANTS.

Nuphar sagittæfolia Pursh (a species of pond lily), I found quite common in De Soto County, and sparsely in the Miakka River. Dr. Chapman credits it to "Georgia to North Carolina," and wrote to me that he had not heard of its growing in Florida. (It has been collected in Santa Rosa County by Mr. A. H. Curtiss.)

Gordonia lasianthus L. (the loblolly bay), grows to be a tree 50 to 80 feet high, yet begins to bloom when only 3 or 4 feet high, continuing to bloom every day for several weeks in succession.

A species of cotton (*Gossypium hirsutum*, perhaps), is a naturalized shrub or tree in this section, sometimes attaining a height of 20 feet. with a diameter of 1 foot. It grows in the woods long distances from cultivation; indeed, I have known of no cotton being raised in this section. Rev. Edmund Lee, of Manatee, Fla., told me that twenty-two years ago a party of movers camped in a lot belonging to him. The women of the party picked over some sea-island cotton, throwing the seed on the ground. This sprang up and grew, and has been continued in propagation ever since. I have seen them in all stages of growth from a foot high to small trees.

The genus *Vitis* is remarkable in this section for the very few fertile vines found. I suppose of those growing in their native habitat not more than one vine in a hundred is fertile. *Vitis Simpsoni* Munson is the second most common species we have, growing in great profusion in the hummocks, especially the low hummocks. I have seen hundreds of them, and yet I have only found five bearing vines and they bear but a few grapes. Of *Vitis coriacea* Shutt, I

have found six bearing vines, and three or four of its hybrids that were bearing. Of the Florida form of *Vitis æstivalis* (which is without doubt a distinct species), I have found six bearing vines. Of *Vitis vulpina* I have found only one bearing vine. The *Vitis Munsoniana* J. H. S. is a very peculiar species. It is by far the most common species we have. Its native habitat is in the hummocks, where probably not one vine in five hundred is a bearing one. It is also abundantly found along the fences, around stumps, and in waste grounds in poor pine lands. These vines have come from seeds dropped by birds, as they are out of their natural habitat. The strange part is that while the vines which grow in hummocks are nearly all sterile, yet those that spring up in poor pine lands, along fences, and around stumps are largely bearing vines, probably one-half of them or more. The leaves of many of the vines remain on all winter, turning red, yellow, and the various autumnal tints that leaves assume in a northern forest. Rarely, the leaves remain green all winter, especially south of this place. Several of the bearing vines of this species are ever-blooming; that is, they bloom at intervals from April to October, but as the stamens of the fertile flowers are short and declined, the pollen fails to fertilize the stigmas; in consequence, they only set one crop (or rarely a second one) fertilized by the pollen of the latest blooming sterile flowers. Botanists have usually described *Ampelopsis bipinnata* Mx., as destitute of tendrils. Linnæus seems to have been of this opinion when he named it *Vitis arborea*. Here, however, it has a full supply of once-forked tendrils the same as any species of *Vitis*. I never saw a vine of it but what had its intermittent forked tendrils the same as the highest species of *Vitis*.

Cissus incisa and *Cissus sicyoides* L. bloom abundantly in this section, but never set fruit. I have had both species in cultivation in my yard for years, but have never seen a berry either in the wild or cultivated state.

Indigofera tinctoria L., wild indigo, is described as being herbaceous. For three years this plant has continued growing, blooming, and producing seed on my grounds, and has become a shrub. It will probably continue to grow until killed by frost.

Erythrina herbacea L. is described, as its name indicates, as being herbaceous. Here it is a shrub or tree. On Terraceia Island, near the mouth of Tampa Bay, where the soil is very rich and frost seldom occurs, it grows to be a tree 30 feet high, as I have been informed by a reliable botanist. At Cedar Key I found it to be a shrub 3 or 4 feet high.

Chapmania floridana T. and G., a leguminous plant, is a morning bloomer, withering and closing about 8 or 9 o'clock a. m., when the sun shines, or a little later when cloudy.

*Jussiœa erecta** L. I have found growing in two or three places in Manatee. It varies greatly in size, from a simple-stemmed plant of a few inches in height to a tall branching one several feet high, and always grows on dry land. The tallest one I saw was 9½ feet high and began to branch 2 inches from the ground. It is an annual, and begins to bloom when but a few inches high. The flowers are small and the petals caducous.

The *Citrillus vulgaris* Schrad. (watermelon) is naturalized along the Manatee River. Some years ago I followed down the north side

*J. acuminata, Sw.

of the river below Palmetto. For a distance of probably 2 miles I found watermelon vines growing in the channel of the river every few rods. They were growing in pure sand so close to the salt water that it looked as if they must have been wholly or partly submerged at high tide. All along the bank of the river where these vines grew it was primitive forest. None of the land was cleared or cultivated, and not a habitation in sight on that side of the river. Watermelon vines are spontaneous on my place, springing up where I have never dropped a seed, those from which the vines came having perhaps been carried by rats. Strange to say, though I have often planted seed on the same lot, not one of them ever ripened a melon, while the volunteer ones bore fine fruit, one of them weighing 28 pounds.

Opuntia tuna Mill., a prickly pear, is rarely mentioned in our botanies, though it is common along the coast. It produces large, obovate joints, and long stiff spines, so that I have had them penetrate my boots while walking among them. It is many times larger than the *Opuntia vulgaris* which is so common in pine land. Sometimes, but rarely, it is found in hummocks some distance from the coast.

Psidium Guaiava Raddi, the guava plant, seems to have been overlooked as a naturalized shrub in Florida. Dr. Chapman, in the Supplement to the Southern Flora, says it is cultivated at Manatee, and occurs along the west coast of Florida. There are thousands of these shrubs growing wild all over this section of the State. They grow so thickly in some places along the streets of Manatee that they hide from view the fences, and the spontaneous ones usually do better than those that are planted.

Sambucus Canadensis L., the elder bush, which is only a shrub in the Northern States, often becomes a tree in south Florida. One of my neighbors has a tree of this species that is 13 or 14 inches in diameter.

Helianthus littoralis Chap., a wild sunflower, is a new species, which has been confounded with *H. floridanus* Gray. The new species is a perennial, with tuberous roots, stems slender, rough, covered with short rather stiff hairs, simple, 2 to 2½ feet high; leaves lanceolate, rough, 1-veined, sessile, margins revolute, entire, rounded at the base, 1 to 1½ inches long, 3 to 4 lines wide, close together on the stem; stems generally with a single head, sometimes corymbosely branched near the summit, the branches terminated by a solitary head; heads 6 to 9 lines in diameter; disk yellow; rays about 10, an inch long, narrow; scales lanceolate, acute, spreading, in about 4 rows. Plant begins blooming in May or June and blooms for several months. It does not exude a resinous gum when bruised.

Ulmus Americana L., the American elm, is found in Manatee County, but instead of being the large magnificent tree that it is in the North, it is a mere pigmy. The largest specimens I have seen in this section are not more than 25 or 30 feet high and 5 or 6 inches in diameter.

The genus *Smilax* is a most difficult one as here found. There are nine species in this county, and the identification of most of them is little better than guess-work. Dr. Chapman and Professor Darby say that the berries of *Smilax pumila* Walt. are white or whitish. Professor Wood says they are red, and he is correct so far as I have observed, for in every instance I have found them red.

Vittaria lineata Swz. is a remarkable epiphytic fern. Its long,

narrow, grass-like fronds look far more like an endogen than anything else, at first sight. I have seen the fronds 2 to 2½ feet long, and not more than 2 or 3 lines wide.

Nephrolepis exaltata Schott, grows either as an epiphyte on trees, or more commonly here in deep shady woods in the rich leaf mold among the trees. It grew very abundantly along a ditch in poor pine land where it was entirely exposed to the sun in the village of Manatee; so it appears to be perfectly at home as an epiphyte, or growing in dense shade in leaf mold in the ground, or in poor pine land fully exposed to the sun.

UNIOLA PALMERI.

A NEW GRASS OF ECONOMIC IMPORTANCE.

In 1885 Dr. Edward Palmer collected, near the mouth of the Colorado River, some specimens of a grass from which he said the Cocopa Indians obtained the seeds in large quantities and used them as food. At the time he was there the grass was out of flower; he found only a few disconnected spikelets, and the botanical characters could not well be determined. In April of the present year Dr. Palmer, being employed by the Department of Agriculture to make botanical investigations, made another visit to the locality and obtained in that region specimens in good condition, enabling me to locate the plant botanically. As the genus Uniola is defined by Bentham & Hooker, our grass must be considered as of that genus. Its general appearance and habit is that of Distichlis, from which it differs in having four of the lower glumes (instead of two only) in each spikelet empty, *i. e.*, without palet or flower, and in the disarticulation of the rhachis between the spikelets of both sexes—that is, the spikelets break apart between the several flowers when mature. This disarticulation occurs also to some extent in the fertile spikes of Distichlis, but not in the male or infertile ones. On the other hand it differs from Uniola in its diœcious character, and here agrees with Distichlis. It seems in fact to connect these two genera, but so long as the two are kept distinct it must stand as Uniola. Specifically it is new, and I have given it the name of *U. Palmeri*.

The following notes I collect from Dr. Palmer's letter:

The specimens were collected at the Horseshoe Bend of the Colorado River, 35 miles south of Lerdo by the river, and 12 to 15 miles from its mouth. This is the most extensive locality of the grass, thence extending down to the mouth of the river. It covers a space of from 1 to 20 miles wide, and occurs on both sides of the river. It is estimated that there are from 40,000 to 50,000 acres covered with this grass. It grows from 2 to 4 feet high, from strong, deep root-stocks, frequently many culms from the same root. The stems are covered to the top with the sharp, stiff leaves. The sterile plant grows more or less mixed with the other, but at times in masses entirely by itself. Dr. Palmer noticed several forms. One of these is more slender, with the leaves shorter, more numerous, and more finely pointed. This, he says, grows on land that has but little overflow. Where, by changes in the river, any patches are left above tide-water, they soon die.

The Indians come together here at the proper season, in April, and gather this, to them, important article of food. As its quantity depends on the overflow of the tides, and the tides are sure to occur, they have an assured crop without any other labor than gathering and caring for the grain. The gatherers enter the fields as soon as the tides have entirely run off, where the soil is an adhesive clay so soft that the Indians often sink nearly to their knees in gathering the grass, and as soon as the tide begins to flow they return with the result of their labor to their camps. It is quite difficult to pull up the plant by the roots, as these are often two to four feet long, but the stems are brittle and easily break off above the root. The Indians, in harvesting, use any old knife, or if they have none they take a flat piece of wood and form an edge on each side, and with this they sever the stems, the left hand grasping the tops, which are then thrown into a basket. The rigid, spiny-pointed leaves make the process a painful one. The grain has to be cut when a little green, because of the easy separation of the spikelets. In order to dry the heads as quickly as possible, large fires are made, and the heads are piled around so that the flames penetrate between them. When they have been sufficiently exposed to the fire a stick is used to thrash the heads, which breaks up the spikelets, but does not separate the chaff or glumes from the grain. The dried and dissevered spikelets are then taken to a piece of ground prepared for the purpose, and the Indians tread upon and rub the grain between their feet until the seeds are shelled out.

This process is more easily accomplished after the grain has been exposed a while to the sun, but in any case it is pretty trying to the feet because of the sharp, stiff points of the chaff. The action of the tide knocks off and carries away considerable of the grain, but this is left in rows at the edge of the contiguous dry land, and the Indians gather much of it and rub it out. They have to be expeditious in their harvest, as wind storms are liable to arise and destroy or injure the product of their labors.

Dr. Palmer was accompanied on his trip by two gentlemen connected with the U. S. Fish Commission, who took photographs of the grain field, and of the thrashing and treading out of the seed from the chaff.

It is not yet ascertained how far up the river this grass extends, but probably to the limit of tide-water, and in this case it will yet be found within our boundaries. The related *Distichlis maritima* grows not only on the sea-coast, but in nearly all saline and alkaline grounds in the interior of the country, but we can not infer from that fact that this species might be cultivated outside of the reach of the tides.

USEFUL DESERT PLANTS.

The southwestern portion of the United States, embracing western Texas, New Mexico, Arizona, and southern California, constitutes what may be called the desert belt. In this stretch of country there are many mountain ranges, with numerous high peaks, whose sides are covered with timber, and their bases covered with grass and supporting thousands of cattle and sheep. But a great portion of the country possesses many of the natural features of the northern portion of the African Sahara. Several years ago Mr. Melivier, a member of the Acclimation Society of France, visited Mexico and our

southwestern borders in order to study the vegetation of the arid and desert regions. He was struck by the similarity of climate between this region and southern Algiers. In his report he states that he found a large desert belt, extremely dry, with winters of copious rains, with such intense solar radiation and dryness of air as to cause enormous variations of temperature and humidity. Nothwithstanding these conditions, so unfavorable for richness of vegetation, he found that there was a greater element of utility in the native productions of this country, and that several of the wild plants might with benefit be introduced into the Algerian Desert. Among these plants he mentions the mesquite and screw bean, the cactus fruits, the different agaves and yuccas, and the nut pine. In some places he found a considerable Indian population of good physical development, who obtained their subsistence largely from the plants native to the country, which furnished them edible grains, sweet fruits, alcoholic drinks, and useful fibers. The observations of Mr. Melivier are extremely interesting, but we only allude to them here in order to draw some attention to the possibility of an extensive practical utilization of the native desert productions. One of the most widely diffused plants of the desert region is the prickly pear or cactus in many forms. In some parts of western Texas cattle-men have learned to utilize these plants in feeding and fattening domestic animals. They produce abundantly a pulpy fruit which is not palatable, but the plants are essentially like the "tunas" of Mexico, which furnish a rich saccharine and nutritious pulp, and these valuable varieties can easily be substituted for the wild ones. In Arizona and southern California the tree cactus, or *Cereus giganteus*, and several related kinds furnish pulpy fruits, which form an important article of Indian food, and a proper selection and cultivation of the best varieties of these might be made useful and profitable. Next to the cactus family, the various kinds of yuccas and agaves form a striking feature of vegetation, and many of them are utilized by the native inhabitants for food and for fibers. Some of these have a pulpy, edible fruit, and most of them furnish a mass of condensed foliage, which in the young state is roasted and eaten with great relish and is an unfailing resource in time of scarcity of other food.

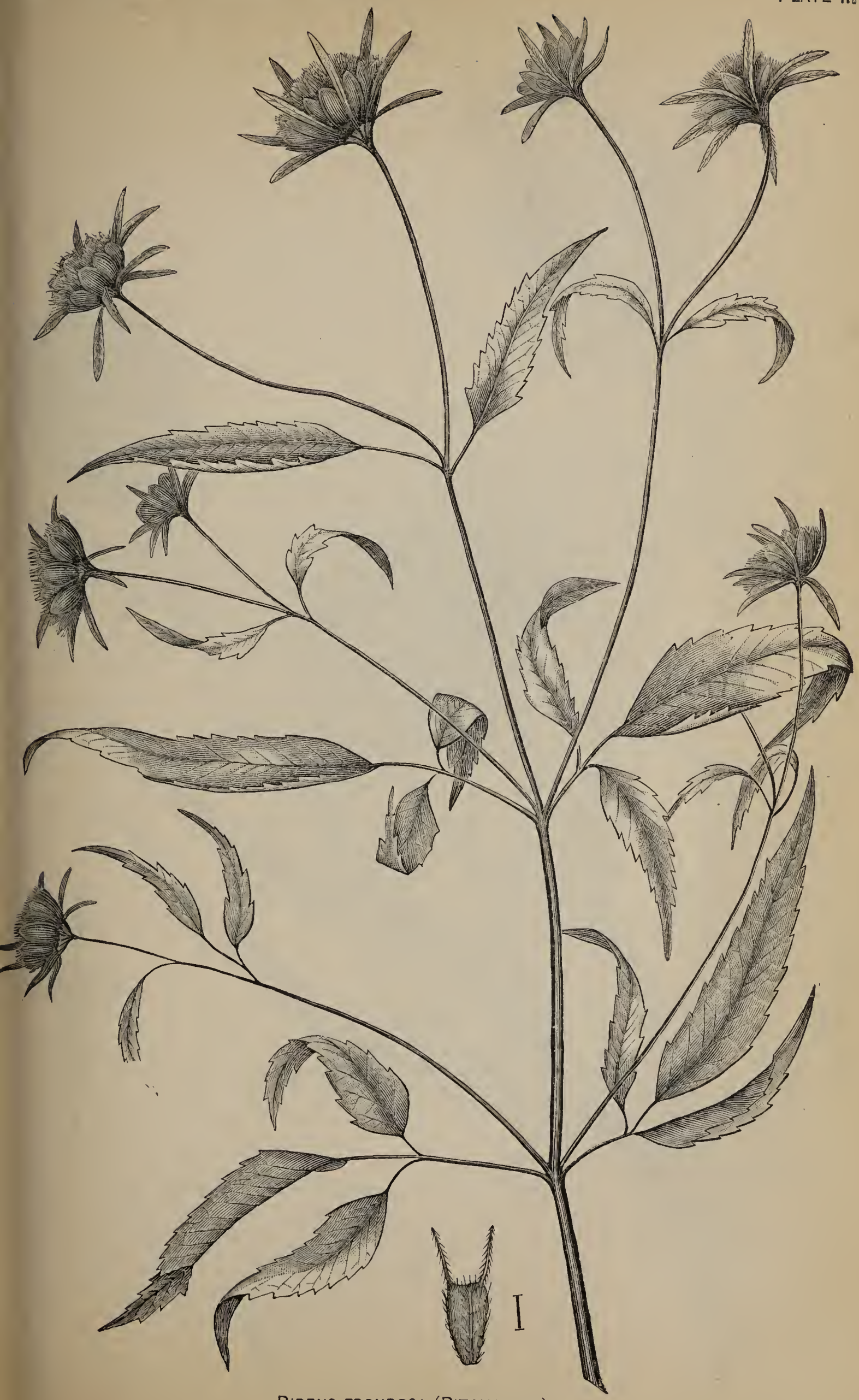
One of the most widely diffused plants of the arid belt is the mesquite tree or bush. This produces two crops per year of beans, which have a high value as feed for stock. The aborigines of the country made great use of these beans as an article of food. The production of this desert fruit might be developed to any extent desired. Another desert product having great prospective value is a root called canaigre, or botanically *Rumex hymenosepalus*. The root contains a large percentage of tannic acid, and it is being employed in tanning leather. If it were brought under cultivation it could be raised in great quantities and with much profit. It is also reputed to have medicinal properties analogous to those of Turkey rhubarb. The common creosote bush of the desert (*Larrea Mexicana*) furnishes a gum which is a good substitute for the shellac of commerce. The mesquite bush, in addition to the value of its beans, also produces a gum which is an excellent substitute for the gum arabic of commerce.

The above-named plants are among those which may be utilized without irrigation. When we come to add the influence of an artificial supply of water, there is scarcely any product of semi-tropical countries which can not be abundantly produced.

LIST OF PLATES.

REPORT OF THE BOTANIST.

BRASSICA SINAPISTRUM (CHARLOCK).



BIDENS FRONDOSA (PITCHFORKS).

CNICUS LANCEOLATUS (BULL THISTLE).

R. STOWELL, DEL.

SONCHUS OLERACEUS (SOW THISTLE).

L. R. Stowell del.

ANTHEMIS COTULA (MAYWEED).

CONVOLVULUS SEPIUM (HEDGE BINDWEED).

DATURA STRAMONIUM (JIMSON WEED).

RUMEX CRISPUS (YELLOW DOCK).

L. R. Stowell del.

RUMEX OBTUSIFOLIUS (BITTER DOCK).

L. R. Stowell del.

AMARANTUS SPINOSUS (THORNY AMARANTH).

SHORTIA GALACIFOLIA.